NEWS REPORT

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL

Volume XI, Number 5 SEPTEMBER-OCTOBER 1961

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Editor: WALLACE W. ATWOOD, JR.

Editorial Office: 2101 Constitution Ave., Washington 25, D. C.

NEWS REPORT is published bimonthly by the National Academy of Sciences–National Research Council. It is designed to report current activities of divisions, boards, committees, and other established groups within the organization, and to record news of cooperating Societies and developments in the field of international science. It is distributed without charge to organizations and individuals directly associated with the Academy–Research Council; it is available to others at the rate of $2.00 per year.

NEWS REPORT

National Academy of Sciences National Research Council

VOLUME XI *September–October 1961* NUMBER 5

Advances in Artificial Limbs

A. BENNETT WILSON, JR., *Staff Engineer*

Committee on Prosthetics Research and Development

BECAUSE of accidents, warfare, disease, and congenital abnormalities, the human population since the earliest recorded history has included a substantial proportion of amputees and cripples representing every conceivable level of disability—many unable to help themselves. Perhaps because these people represented an economic drain upon the balance of the population, the history of the treatment afforded them by society and by otherwise responsible government has, until very modern times, been largely a long and more or less disgraceful example of man's inhumanity to man.

But we live now in an enlightened age. The social reforms of the 19th and 20th centuries brought with them an expanding public consciousness of many responsibilities not theretofore recognized. Among these has been a growing public acceptance of responsibility for providing appropriate assistance for the less fortunate in the community of men. In this favorable intellectual climate, there has been an increasing tendency to apply public funds in support of modern scientific research and development aimed at the solution of some of the problems of disease and disability. This changing picture, which is now to be seen in almost every field of public welfare and in institutions both public and private, comes, in the area of amputations and artificial limbs, at the end of a long series of sporadic and largely unsystematic empirical attempts at the development of suitable limb substitutes.

Because periodic warfare tended to produce periodic contingents of new amputees, and doubtless also because of the emotional recoil that besets people after every major conflict, war has always generated an increased interest in the problems of amputees and has been followed by a flurry of impetuously conceived inventions relating to artificial limbs. History records, for example, a distinct rise in interest and achievement on the continent of Europe after the Napoleonic Wars, again in the United States after the American Civil War, and still again after World War I, notably in Germany, Belgium, and England. But in every instance these efforts have subsided to the previous peacetime level soon after hostilities had ceased and the wounded had been absorbed into civilian life, their residual problems largely forgotten.

For almost a quarter of a century after World War I, systematic efforts toward genuine improvement in artificial limbs,

particularly in the upper extremity, lay almost dormant. It was World War II that was responsible for still another revival of interest in the problem of amputee rehabilitation, even though by that time, in our highly mechanized society, disease and accidents—in the home, on the farm, in the factory, on the highway—were accounting for many, many more amputees than were produced in the military campaigns.

In any event, servicemen who had suffered amputations during World War II displayed keen disappointment with the artificial limbs provided them upon their return to the United States. Since they were now all familiar with extremely intricate mechanical, electrical, and hydraulic mechanisms, it was incomprehensible to them that a country so adept at turning out efficient weapons of destruction had seemed to have failed so miserably in providing substitutes for limbs lost in battle. Fortunately, in those days there were both the will and the wherewithal to establish a systematic investigation of the whole field of limb prosthetics.

When the problem came to the attention of The Surgeon General of the Army, he turned to the National Academy of Sciences with a request for assistance. An investigation by the Academy early in 1945 revealed that no sustained scientific approach had ever been made to the development of artificial limbs; that virtually all devices in use had been developed without the benefit of adequate design criteria, usually by amputees to fill partially their particular needs and who then made these devices available to others; and that the industry supplying limbs, serving a comparatively small and relatively impecunious segment of the population, was not prosperous enough to support a systematic research and development program of any consequence. In view of these findings, the Academy, using funds supplied first by the Office of Scientific Research and Development, then by the U. S. Army and the Veterans Administration, organized and operated by subcontracts with universities and industrial firms a research and development program in the field of prosthetics which has since come to be known as the Artificial Limb Program. This organizational structure prevailed until July 1, 1947, at which time the program was reorganized so that the Academy became the coordinating agency for projects sponsored by the Veterans Administration, the U. S. Army, and the U. S. Navy.

In mid-1948, the 80th U.S. Congress, recognizing the need for continuity in a program of this kind, initiated and passed Public Law 729,[1] which authorized the expenditure of $1,000,000 annually for prosthetics research. The Veterans Administration was designated as the appropriate agency for the administration of the funds thus made available, and the Administrator of Veterans' Affairs was directed to make the results of such a program available to all, veteran and civilian alike.

Until 1955, the majority of the work was supported by the Veterans Administration through contracts with universities, industrial laboratories, and the National Academy of Sciences under the provisions of Public Law 729 (80th Congress), while the Army and Navy cooperated by maintaining laboratories within their own organizations. Although Public Law 729 authorizes the Administrator of Veterans' Affairs to make results of research available to civilians, use of funds is for the most part restricted to research and development for adult cases. The Office of Vocational Rehabilitation, in addition to supporting the education program originally started with Veterans Administration funds, supports a number of research projects in prosthetics and orthotics under the provision of Public Law 565 (83rd Congress); the Children's Bureau has made available, through grants to several states, funds for research in the prosthetic problems of children, and the National Institutes of Health has awarded grants to cover part of the necessary medical research.

At the beginning of the Artificial Limb Program, it was the general feeling that the solution to the problem lay in developing new devices, and rapid advances were made by applying new materials and methods. It soon became apparent, however, that much more needed to be known about the func-

[1] Public Law 729, 80th Congress, was superseded June 17, 1957, by Public Law 85-56, 85th Congress, with essentially similar provisions.

tions provided by normal limbs before realistic design criteria could be developed. As progress was made, it later was shown that medical and surgical research, some of it of an extremely basic nature, was just as necessary as device development. Thus the program became one of interdisciplinary research.

As new concepts, introduced through the efforts of the Artificial Limb Program, were proven to be valuable in the rehabilitation of amputees, the need for essentially the same type of program in orthopedic bracing, or orthotics, became apparent. Because much of the fundamental data found necessary for progress in prosthetics was applicable to a program in orthotics, it was only natural that orthotics be added to the program of artificial-limb research. This was done beginning, in a limited way, about 1957.

At the present time in the United States there are 33 separate groups engaged in some phase of research and development related to artificial limbs or orthopedic braces, or both. Some are responsible for studies of a very fundamental nature, such as the biomechanics of human locomotion, in order to develop design criteria. Others are engaged in the design and development of devices. Still others are responsible for the development of methods of fitting limbs and braces. An evaluation laboratory has been established for testing each new item or idea as it progresses from one phase to the next.

In an effort to maintain a well-balanced program, the various activities of the research and development units engaged in both prosthetics and orthotics are correlated and coordinated by the Committee on Prosthetics Research and Development (CPRD), Division of Engineering and Industrial Research, under the chairmanship of Howard D. Eberhart, Professor of Civil Engineering, University of California, and supported by funds from the Veterans Administration, the Office of Vocational Rehabilitation, and the National Institutes of Health. CPRD also publishes the journal *Artificial Limbs* in order to ensure a broad dissemination of the results of research.

To bring results of the research program to the medical profession and its ancillary services, the Committee on Prosthetics Education and Information (CPEI) was organized in 1957. Originally established within the framework of the Division of Engineering and Industrial Research, CPEI now operates as a unit in the Division of Medical Sciences. C. Leslie Mitchell, Surgeon-in-Charge, Division of Orthopedic Surgery, Henry Ford Hospital, and long associated with the Artificial Limb Research Program, is the present chairman. A close liaison between the two committees is maintained.

As a result of work done during the past 16 years, virtually every aspect of limb prosthetics has undergone dramatic changes. Because of new devices and methods of fitting, it has been possible to eliminate the old concept of "ideal" sites for amputation, thus preserving in many patients more function than was the case in the past. The "synergistic" action produced by physicians, engineers, prosthetists, and psychologists has been carried forward into the general practice of prosthetics by the formation of clinic teams for management of amputees. Improved devices permit more function, and newer fitting and alignment methods based on biomechanical data have resulted in improvement in both comfort and function. At the same time, in many instances use of the new devices and techniques has permitted economies, not only by reducing fabrication time but also by reducing the time required for the rehabilitation process. Short-term courses are offered at three universities to physicians, therapists, prosthetists, and rehabilitation counselors so that results of research can be disseminated to the field rapidly.

The time required for results of fundamental research to reach widespread use in the form of practical devices is much longer than is realized generally. Often more than 20 years elapse between fundamental discovery and practical application. By carefully coordinating the work required in the various phases between fundamental research and application, and with the cooperation of several universities in offering short-term courses as new concepts are developed, the Artificial Limb Program has been able to reduce this time to between 5 and 7 years. Thus there has been evolved

a method whereby the results of research rehabilitation can be translated into general use quickly and effectively.

Unlike the interests developed as a result of previous wars, that stemming from World War II has been kept very much alive largely because through the cooperation of several Federal agencies, universities, the medical profession, the prosthetics profession, and others, the organized, interdisciplinary, scientific approach has given useful results which have reached the amputee in a relatively short time. Although progress to date has been most gratifying, some areas of the problem have hardly been entered and whole new avenues need to be opened.

Advisory Committee on Civil Defense

RICHARD PARK, *Technical Director*

THE TASK of providing technical advice in civil defense matters has some special, if not unique, characteristics. For one thing, many disciplines, including the psychological, sociological, political, and economic, are involved; for another, most of the delays and failures in civil defense appear to be caused by problems not readily amenable to scientific and technical treatment; lastly, there are few areas where more highly subjective, and sometimes emotional, opinions and viewpoints can be found, and where, at the same time, there is less understanding of what is involved, not only by the general public, but also by otherwise well-informed people.

The first official step in the establishment of an Advisory Committee on Civil Defense was a letter from Val Peterson, Director of the Federal Civil Defense Administration, to Detlev W. Bronk, President of the National Academy of Sciences. It was dated December 1953 and requested that the Academy establish an advisory committee to provide scientific and technical analysis and support for the national civil defense effort.

In May 1954, a contract was concluded between the Academy and the Federal Civil Defense Administration (FCDA), and in July, Willard Bascom began work as Technical Director, assisted by a small staff. By the end of the year, the appointment of the Advisory Committee was completed under the chairmanship of Merle Tuve, Department of Terrestrial Magnetism, Carnegie Institution of Washington.

During the first two years of the existence of the Committee, the staff was actively engaged in a variety of projects. These included studies of evacuation exercises; reviews of various public warning systems; investigation of simple, inexpensive instrumentation; suggestions concerning the size and scope of a civil defense research program. The Technical Director and his staff prepared many papers on these and other subjects.

The initial phase of the Advisory Committee's history can be said to have ended with the congressional hearings on civil defense before Representative Holifield's Subcommittee of the House Committee on Government Operations early in 1956 when the Chairman and Technical Director testified. These hearings exemplified a fundamental problem that the Advisory Committee has continuously had to face: the difficulty of separating policy and political matters from technical considerations.

Unsatisfactory progress in civil defense cannot be attributed to technical difficulties. The strictly technical problems as a rule are satisfactorily solved or appear quite solvable. But action by the people, by Congress, and by various levels of government has been far from sufficient. Thus a group such as the Advisory Committee, when it examines the civil defense program in all its detail, comes to the conclusion that the only way to achieve a capability for protecting the people from nuclear attack is by changing national policy, or by influencing leadership, or by educating the public, or by

improving the planning and administration of the program.

This conclusion was evident from the testimony given before the Holifield Subcommittee in February 1956 by the Chairman and Technical Director, and in the correspondence of other Advisory Committee members with Representative Holifield.

The second phase of the Advisory Committee's life began in October 1957, when Lauriston S. Taylor, Chief of the Atomic and Radiation Physics Division of the National Bureau of Standards, who had served on the Committee from the start, became chairman and Richard Park became Technical Director.

In the spring of 1958, the Federal Government in the course of a re-examination of civil defense arrived at a point where the answers to certain questions were urgently needed. These questions concerned the adequacy of the Federal Government's research program in the non-military defense area. Specifically, were the research programs pursued by the various agencies adequate to provide a basis for action? Were the programs properly coordinated and integrated? Was there adequate interchange of information among agencies to prevent duplication of research and still enable each agency to discharge its responsibilities? Were there any major gaps in the research effort which needed to be filled?

These questions were referred to the Academy with the request that an appraisal be made and a report submitted within two months. The Advisory Committee was called upon to undertake the task. This it did by supplementing its membership with temporary members and consultants. The result was the Advisory Committee's Report "The Adequacy of Government Research Programs in Non-Military Defense." Because of the brief time available, and the fact that the overriding purpose was to provide the top policy-forming councils of the government with specific answers to specific questions, the report concentrated on certain aspects of civil defense: protective measures against fallout radiation; problems of human behavior before, during, and after nuclear attack; bio-medical questions concerning the effects of radiation on humans; and recovery problems.

Briefly, the report concluded that the level of knowledge was more than sufficient to support the construction of a protective capacity; that adequate shielding is the only effective means of preventing radiation casualties; that, while the available information was adequate to justify immediate action, continued research effort was needed; and that administrative improvements were called for in order to get better efficiency and more effective results. Lastly, the report concluded that the achievement of effective, nationwide non-military defense was dependent on "the assignment of a proper status in relation to military defense."

This "adequacy report" had a very limited distribution. One of the reasons was its rather technical, specialized nature. Another was the fact that its coverage of civil defense programs was confined to the areas in which specific questions had been raised. Following its publication, the Committee considered the usefulness of the report as a vehicle to inform and stimulate the interest of the public in civil defense, but concluded that it was useful chiefly as the basis for a more comprehensive document that would contain less technical details. What seemed to be called for was a report giving the current state of technical knowledge in the entire non-military defense area. The objective was conceived as being to educate in civil defense the leaders in government, industry, and the professions. The nature of the threat, the problems and solutions, the status of programs, and a comparison of United States with foreign, particularly Russian, activity were to be included.

The Committee prepared such a report, but found itself in the same dilemma that it had faced at the Congressional hearings. Again arose the problem of discussing policy matters in a technical report intended for public distribution. Again the Committee concluded that the reasons for the unsatisfactory achievement of a capability for protecting the population were not technical. The report further stated that satisfactory progress was unlikely under the national policy that provided no Federal financial support, direct or indirect, for the construction of shelters.

The Office of Civil and Defense Mo-

bilization (OCDM), the successor to the FCDA, while welcoming and encouraging such appraisals, was understandably unwilling to give a wide public distribution under its sponsorship to a report that was so skeptical of the workability of the national policy under which it had to operate.

Hence the report was not published and the Advisory Committee decided to direct its activity away from attempts to inform and influence leadership on civil defense in general and toward the study of specific technical problems found in civil defense research programs. This led to the third and present phase of the Advisory Committee's history.

Actually the third phase had begun before the second ended. It had been evident for some time that research on the fundamental problems of calculating or measuring the radiation protection afforded by various kinds of structures was of vital importance not only in the design of shelter but also in the use of existing buildings. To support this research, the Advisory Committee, in the fall of 1958, established the Ad Hoc Subcommittee on Radiation Shielding with L. V. Spencer of the National Bureau of Standards as Chairman, and with a membership drawn from the government and contracting agencies doing research on the problems of shielding from the ionizing radiation caused by nuclear attack.

The Subcommittee's objectives were to provide *1*) direct advice to the OCDM research staff, through OCDM representation on the Subcommittee; 2) rapid interchange of information, coordination of programs, and stimulation of new ideas among those engaged in this research; and 3) service as OCDM consultants and advisors on the OCDM research program.

One of the reasons why the Subcommittee has been successful in meeting these objectives is that its membership represents most of the total research effort being undertaken in this area. At the same time, this situation was indicative of the small size of the effort and emphasized the vital need for broadening the base of the shielding research programs by getting more men trained and into the work.

The Shielding Subcommittee has been meeting regularly. It prepared a status report in June 1960 that summarized the state-of-the-art and recommended actions to strengthen and enlarge the program. It provided immediate advice to the OCDM on the preparation of the Guides and Manuals for conducting surveys of the radiation protection available in existing structures. It was of assistance to the Naval Radiological Defense Laboratory in its planning and conducting of a symposium on shielding. And it carried out a continuous forum function among its members and thus ensured an improved coordination of individual programs.

The operation of the Subcommittee on Radiation Shielding has served as the pattern for the other special groups, which, with the Shielding Subcommittee, now meet most of the Advisory Committee's responsibility for providing the OCDM with scientific and technical advice. Presently, there are seven of these groups, some fully operative and some in process of formation. Their objectives, histories, and accomplishments are briefly outlined.

In January 1960 the need for examining the citizens' instrument problem, which had been a matter of concern for some time, culminated in the establishment of the Citizens' Instrument Working Group. With Dr. Taylor as acting chairman, the group met to discuss the essential requirements for an instrument that would be available to the individual shelter owner for measuring the radiation hazard.

Two of the group's conclusions were particularly important: *1*) that the instrument should be readable in roentgens per hour and thus give a measure of the degree of danger rather than be only an alarm device; and *2*) that the most difficult problem involved was the preparation of simple, safe, comprehensive, and adequately precise instructions for telling the shelteree what to do under various degrees of radiation intensity. These conclusions were part of the Working Group's report that was submitted to the OCDM.

The task of preparing instructions in the use of a citizens' instrument has since been assigned to an OCDM contractor. A report became available in March 1961 and the services of the working group were again called upon to comment on its suitability.

These comments generally endorsed the report, with some qualifications and suggested revisions, as a very good first step in meeting a very difficult requirement.

The OCDM mission for estimating damage from nuclear attack and for evaluating available resources is carried out in its National Resources Evaluation Center (NREC). Problems involved in this mission have resulted in request by the OCDM for the establishment of three special task forces.

The Working Group on Fallout Models, under the chairmanship of Harold Knapp, Atomic Energy Commission, has been active since January 1961. Its major objective is to recommend what, if any, modifications should be made in the mathematical model for fallout distribution now used with the computer at the NREC. The Group has been examining available knowledge of the meteorological and radiation aspects of the fallout phenomena and has considered that knowledge in relation to computer limitations, the availability of input information, and the requirements for accuracy in damage assessment work. The Group has given informal advice and recommendations to the NREC and is writing a report.

The second group, established in January 1961 to give assistance to the NREC mission, is the Working Group on Assessing Damage to Livestock from Nuclear Attack, with John Rust, University of Chicago, as chairman. An important phase of resource evaluation concerns the post-attack availability of food. With a substantial part of our total food supply consisting of meat, eggs, milk, etc., it is important to know the effects of nuclear attack, particularly fallout radiation, on cattle, poultry, and other food-producing animals. As was the case with the group studying fallout models, the first objective of this group is to give advice regarding changes in the tables, graphs, and procedures currently used with the computer at NREC. Much has already been accomplished in meeting the first objective in the three sessions held, and a report is in progress.

The third of the groups specializing in the OCDM's damage assessment mission is being established to look at the problem of assessing the damage from the fires caused by nuclear attack. Again, the chief objective is to improve the procedures and techniques used at the NREC for estimating such damage and relating it to the damage from other effects. A small group has agreed to serve, and a preliminary meeting is being arranged. Coordination with the Academy's Fire Research Committee is being maintained.

The last two of the special groups are in the fields of ecology and protective construction. Both are in process of formation.

A preliminary meeting of ecologists and of those interested in the ecological problems that might arise in the aftermath of nuclear attack was held in May 1961. The question of how serious these problems might be as compared to the more direct effects of nuclear weapons was raised, as well as a discussion of what sort of working group would best assist the OCDM in the ecological area. Written comments and suggestions from the participants were sought and are being received.

The latest of the groups which the Advisory Committee has approved is the Subcommittee on Protective Construction. Merit White, University of Massachusetts, has agreed to serve as chairman, and initial membership is complete. This Subcommittee will have as a major objective the task of making the available information on protective construction more readily accessible to architects and construction engineers. It will work closely with the Building Research Institute.

It is probable that, as it develops, the Protective Construction Subcommittee will include in its field of interest a consideration of the environmental engineering needed in protective structures. In that area, the Advisory Committee was a joint sponsor, with the National Bureau of Standards and the OCDM, of a meeting in February 1960, and published the proceedings of the meeting.

The shifting of the responsibility for civil defense to the U. S. Department of Defense is not expected to cause significant changes in the Advisory Committee's objectives, and plans for the future envisage a continuation of the present procedures. Special task forces will be formed as required and will work until the task assigned is completed.

SCIENCE NEWS

AUTUMN MEETING NATIONAL ACADEMY OF SCIENCES

The autumn meeting of the National Academy of Sciences will be held at the University of California at La Jolla on October 29 and at Los Angeles from October 30 through November 1. All the scientific sessions will be open to the public.

Headquarters for the La Jolla meeting will be the Sumner Auditorium on the La Jolla campus, and members of the Academy are requested to register there on arrival. The scientific sessions on Sunday, October 29, will be held in the various lecture rooms on the La Jolla campus of the University.

The scientific sessions on Monday, Tuesday, and Wednesday (October 30–November 1) will be held in the lecture rooms of the Los Angeles campus of the University of California. On Monday morning, October 30, buses will convey the Academy members from La Jolla to the Los Angeles campus for the meetings scheduled there.

A short business meeting for members only will be held on Monday at noon. In the evening the customary public lecture will be given by Willard F. Libby on "Space and Education." On Tuesday afternoon at 2:00 p.m. there will be a Symposium on Particles and Fields in Space with Gordon J. F. MacDonald, University of California at Los Angeles, as chairman. The participants will be:

A. J. Dragt, University of California at Berkeley
Edward Gerjuoy, E. H. Plesset Associates, Inc.
Gordon J. F. MacDonald, University of California at Los Angeles
T. A. Farley, Space Technology Laboratories, Inc.
N. L. Sander, Space Technology Laboratories, Inc.
Norman F. Ness, Goddard Space Flight Center
R. C. Wentworth, Lockheed Corporation

In addition to the scientific sessions, Chancellor and Mrs. Herbert F. York will hold a reception on Sunday evening at their home in La Jolla. Preceding the Academy dinner on Tuesday evening, October 31, Chancellor and Mrs. Franklin D. Murphy will receive the members of the Academy, their wives, guests, and participants in the scientific program at their home in Los Angeles. Special programs have been arranged for the visiting ladies.

The Committee on Arrangements for the autumn meeting is composed of the following Academy members: Louis B. Slichter, *Chairman;* Hugh L. Dryden, *ex officio*; Leason H. Adams; Jacob A. Bjerknes; Donald J. Cram; David T. Griggs; Joseph Kaplan; Donald B. Lindsley; Willard F. Libby; Horace W. Magoun; Joseph E. Mayer; William W. Rubey; Harold C. Urey; Saul Winstein; and William G. Young.

CHEMICAL NOTATIONS SYSTEMS PROJECT

The May-June issue of News Report (Vol. XI, No. 3) contained an announcement of the Chemical Notations Systems Project along with the names of the members of the Advisory Committee and staff.

Some 80 organizations were invited to participate in the project. Some 30 organizations have been interviewed by at least one staff member. Most of these have been chemical companies, but certain academic institutions, research institutes, and groups or companies active in chemical documentation also have been, or will be, included.

Most of the chemical companies interviewed use *non-specific codes* of varying degrees of complexity to represent chemical structures of organic compounds. These codes are commonly recorded on either edge-notched or machine-punched cards. In a few cases, the structural information is also stored on magnetic tape, and additional organizations are contemplating the use of magnetic tape.

Very few organizations actively use *chemical notations* at present. For mechanized searching of internal files most, but not all, organizations consider a non-specific code to be at least as useful as a unique notation.

It is hoped that the final report of this project can offer suggestions and guidance for future applications of chemical codes and notations as well as possible mechanisms by which the Academy–Research Council can facilitate future work in this area, if this appears desirable.

H. P. ROBERTSON

It is with deep regret that NEWS REPORT records the passing of H(oward) P(ercy) Robertson, Foreign Secretary of the National Academy of Sciences on August 26. Severely injured in an automobile accident sixteen days earlier, he appeared to be well on the way to recovery when death intervened suddenly and unexpectedly.

A professor of mathematical physics at the California Institute of Technology, Dr. Robertson was especially well-known for the broad range of his research interest, and was the author of numerous articles on differential geometry, theory of relativity, quantum theory, cosmology, and applied mechanics.

During and following World War II, scientific problems related to the military occupied much of his attention. For his war service he was awarded the United States Medal of Merit for "solving complex technical problems in the fields of bomb ballistics, penetrations and patterns, and enemy secret weapons."

At the time of his death, he was chairman of the Defense Science Board, Office of the Secretary of Defense, and a member of the President's Science Advisory Committee. In 1958, he became one of the members of a committee established to propose a United States program for the international control of space exploration and just recently outlined a plan to use satellites to test Einstein's theory of relativity.

His association with the Academy-Research Council began in 1925, when he was granted a National Research Council fellowship to study the mathematical aspects of the quantum and relativity theories at the universities of Goettingen and Munich. The fellowship was renewed twice, so that he remained in Germany until August 1928.

In the late 40's, he became a member of the Division of International Relations of the Research Council and in the early 50's was a member of the Division of Mathematics. At the same time he served on various committees of the Division of Physical Sciences. In 1951 he was elected to membership in the Academy, and in 1958 he became its Foreign Secretary. His distinguished service as an Academy officer was cut short at a time when his dynamic personality and clear positive thinking were greatly needed in the field of international affairs.

Speaking on behalf of the Officers and Council of the Academy, President Bronk expressed their profound sense of loss in the passing of their colleague and friend in the following message to Mrs. Robertson:

> Distinguished scientist, selfless servant of the national interest, courageous champion of the good and the right, warm human being, he gave richly to us and to all from his own great gifts. We are grateful for the years with him. We mourn the loss of his presence but rejoice in the legacy of his wisdom and his strength.

COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT

On August 7 and 8, at the request of the Chairman of the Committee on Prosthetics Research and Development, an ad hoc committee met in Washington to develop plans for carrying out the objectives of the Committee during the present fiscal year. As a result of the meeting several small conferences are being scheduled and several ad hoc committees and study groups are being formed.

A small working-level conference to delineate present practices in fitting and fabricating total-contact sockets for above-knee prostheses will be held during the autumn. Another conference will be concerned with upper-extremity orthotics. Its primary purpose will be the interchange of information among the various institutions engaged in research and development of braces for the impaired upper extremity.

At the suggestion of the Subcommittee on Child Prosthetics Problems a design conference on prosthetic devices will be held. The technique known as "brain-storming" will be employed by a small group of engineers and physicians in an effort to develop new approaches to some of the design problems that thus far have defied satisfactory solutions.

A study group will be formed to determine the present status of amputation surgery and to determine if a research project should and could be initiated.

BUILDING RESEARCH INSTITUTE

Subjects for the seven separate programs which will make up the Building Research Institute (BRI) 1961 Fall Conference have now been determined. The conferences, which will be held in Washington, D. C., November 28–30, will be organized as follows:

1) A 2½-day research correlation conference on Performance of Plastics in Building is being organized by the Planning Committee on Plastics in Building. Under the chairmanship of Donald R. Gray, Dow Chemical Co., an array of speakers will present performance experience and data for evaluation and discussion by the conference at large.

2) A 1½-day conference on Prefinishing of Exterior Building Components is planned by the Planning Committee on Paints and Coatings. This will contribute further to the development of information on structural components brought out at the highly successful meeting on pre-assembled components held by BRI in the fall of 1960. W. E. Kemp, Koppers Co., Inc., will be chairman for this conference.

3) A 1-day conference on Mechanical Fasteners for Wood will be sponsored by the Planning Committee on Mechanical Fasteners in Building. Much-needed information on shear plates, mechanical fasteners for wood diaphragms, trussed rafters and glue-nailed construction, will be presented at this conference chaired by Jack Godley, Gregory Industries, Inc.

4) Another 1-day conference on Design for the Nuclear Age is being organized by the Planning Committee on Building Design for the Nuclear Age. Under the chairmanship of Gifford H. Albright, Pennsylvania State University, this will deal with fallout protection in various types of buildings.

5) A half-day conference on Methods of Building Cost Analysis is being arranged by the Planning Committee on Methods of Building Cost Analysis. Presenting methods used by some of the nation's top firms, this conference will be chaired by Charles Bogert, engineer with American Telephone and Telegraph Co.

6) Another half-day program on Identification of Colors for Building is being developed and Milo D. Folley of Sargent-Webster-Crenshaw & Folley, Architects, will serve as chairman. This exploratory program will feature a trio of experts on various aspects of color design, and a panel discussion by architects, builders, and others from the industry.

7) A 2- or 3-day program on New Building Research is planned by the Research Committee. In a roundup of widely varied aspects of building research, conference attendants will hear reports on new research projects, results of recently completed projects, and reports on research in other fields that has real importance for the building industry, but which otherwise might be completely overlooked in the flood of scientific information pouring out today.

Preliminary programs and registration materials will be available from Milton C. Coon, Jr., Executive Director, BRI, Academy–Research Council.

HYDRAULIC FILLS AND SLOPE STABILITY STUDIES

The Building Research Advisory Board is undertaking two new advisory studies for the Federal Housing Administration, one on Criteria for Hydraulic Fills and the other on Slope Stability Ratios and Erosion Control. Each is designed to take into account the needs of single- and multi-story residential developments.

The Hydraulic Fills Study is intended to develop criteria for and recommendations concerning design and construction of proposed hydraulic fills, including control of underlying rock and soil materials, and evaluation of existing hydraulic fills along with all underlying rock and soil materials.

The study of Slope Stability Ratios and Erosion Control will be concerned with the design and construction of cut-and-fill slopes (including soil, structural, and vegetative stabilization) and the design, construction, and stabilization of drainage channels.

Special advisory committees comprising individuals drawn from the pertinent fields of soils engineering, engineering geology, sanitary engineering, agronomy, forestry, landscape architecture, and heavy construction which employs the hydraulic-fill process will be appointed for each study.

SYMPOSIUM ON POLY-α-AMINO ACIDS

The National Academy of Sciences through the Division of Chemistry and Chemical Technology, the Public Health Service, Office of Naval Research, and the University of Wisconsin Graduate School Research Committee jointly sponsored the First International Symposium on Poly-α-Amino Acids at Madison, Wis., June 19–23, under the chairmanship of Mark A. Stahmann, University of Wisconsin. The 65 invited participants included representatives of Government agencies, industry, private research institutes and universities from the United States, Israel, Japan, England, Germany, France, and Australia whose interests covered the fields of organic chemistry, physical chemistry, biochemistry, physics, crystallography, microbiology, and medicine.

At the opening banquet on Monday, June 19, C. A. Elvehjem and Farrington Daniels greeted the participants for the University of Wisconsin and the National Academy of Sciences respectively. E. Katchalski of the Weizmann Institute of Sciences, Israel, gave the keynote lecture outlining the objectives of the symposium. Thirty-six authors had prepared preprints of their papers which were mailed to participants before the symposium; consequently, each speaker could summarize his paper, thus leaving time for discussion.

The first speaker at each session was asked to emphasize important problems and to evaluate present methods for their solution; summaries and discussions of related papers followed.

The following major topics were discussed: *1*) synthesis and chemical properties of poly-α-amino acids and polypeptides, 2) kinetics and mechanism of the polymerization reaction, *3*) properties of polyamino acid in solution, *4*) protein and polypeptide structure, and 5) biological properties of poly-α-amino acids including their role in enzyme research, action on disease producing agents and their immunochemical properties.

This symposium provided the first opportunity for direct contact between American scientists and their counterparts in several foreign countries, and it is hoped will encourge a continuing interchange of scientific ideas and information which started in the many stimulating discussions during the symposium sessions. The papers and contributions to the discussion will be published as the Symposium Monograph on Poly-α-Amino Acids by the University of Wisconsin Press.

NATIONAL SCIENCE FOUNDATION FELLOWSHIPS

The National Academy of Sciences–National Research Council has again been called upon to advise the National Science Foundation in the selection of candidates for the Foundation's program of regular graduate and postdoctoral fellowships. Screening committees for the various sciences, appointed by the Academy–Research Council will evaluate all applications. Final selections will be made by the Foundation, with awards to be announced on March 15, 1962.

Fellowships will be awarded for study in the mathematical, physical, medical, biological, and engineering sciences; also in anthropology, psychology (excluding clinical psychology), geography, economics (excluding business administration), sociology (not including social work), and the history and philosophy of science. The fellowships are open to college seniors, graduate and postdoctoral students, and others with equivalent training and experience. All applicants must be citizens of the United States and will be judged solely on the basis of ability.

Applicants for the graduate awards will be required to take the Graduate Record Examination designed to test scientific aptitude and achievement. This examination, administered by the Educational Testing Service, will be given on January 20, 1962, at designated centers throughout the United States and certain foreign countries.

Applications for regular postdoctoral fellowships must be received by December 18, 1961, and those for graduate fellowships by January 5, 1962. Further information and application materials may be obtained from the Fellowship Office, Academy–Research Council.

SYMPOSIUM ON FIRE CONTROL RESEARCH

The Committee on Fire Research was co-sponsor with the American Chemical Society of a Symposium on Fire Control Research, held as part of the 140th national meeting of the Society in Chicago, September 3–8. Joseph Grumer, U.S. Bureau of Mines and a member of the Committee on Fire Research, served as chairman of the symposium; and Walter G. Berl, editor of *Fire Research Abstracts and Reviews* for the Committee, and Raymond Friedman, Atlantic Research Corporation, were co-chairmen of the Program Committee.

Fifteen papers were presented by participants from this country and abroad. Foreign papers came from the Joint Fire Research Organization, England; University of Göttingen, Germany; Imperial College, London; and the Sorbonne, Paris. Speakers for the United States came from Johns Hopkins University, Atlantic Research Corporation, Stanford Research Institute, Syracuse University, U.S. Bureau of Mines, National Bureau of Standards, Forest Products Laboratory, U.S. Forest Service, and Reactions Motors Division of Thiokol Chemical Company.

Plans are now being made to publish the papers which contain new and valuable information in the field of fire control.

STAFF APPOINTMENTS

The Office of Scientific Personnel is pleased to announce that **A. Witt Hutchison** has agreed to continue for another year as Assistant to the Director. Dr. Hutchison is on leave from Pennsylvania State University. He received his Ph.D. degree in physical chemistry from Pennsylvania State University in 1931 and has been a member of the faculty since that date. In his present assignment, Dr. Hutchison is assisting with the International Atomic Energy Agency Fellowship Program and the Visiting Research Scientists Program.

The Building Research Advisory Board has announced the appointment of **Robert P. Darlington** as Director of Program Development. Mr. Darlington received his Master of Architecture degree from the University of Illinois in 1956. Since 1953, he has taught at Washington State University and has served as head of the Architectural Research Section, Washington State Institute of Technology. The Board also announced the return of **Robert W. Spangler** as Staff Engineer. Mr. Spangler previously served about 2 years on the Board's staff.

Leonard Harris and **William H. Penrose** have joined the staff of the Maritime Cargo Transportation Conference as analysts. Mr. Harris holds an M.A. degree in economics from the New School for Social Research and was with the Corporation for Economics and Industrial Research (CEIR), Inc. before coming to the Academy–Research Council. Mr. Penrose is a graduate of the U. S. Merchant Marine Academy (1943) and attended the Georgetown University School of Foreign Service from 1949 to 1952. He was formerly with the Office of Civil Defense Mobilization. In addition to their present assignments, they will assume the duties formerly carried out by **Arthur W. Friedberg,** who left on June 30, 1961, to become Chief of Transportation Systems and Cargo Handling Branch, U.S. Maritime Administration.

The Office of International Relations has announced the appointment of **Frank H. Skelding** as a Professional Assistant. Mr. Skelding attended the Camborne School of Mines in Cornwall, England, and the Mackay School of Mines in Reno, Nev. Before coming to the Academy–Research Council, he worked as a geologist and mining engineer for various mining companies and research institutions in England, Sweden, Germany, Canada, and the United States.

Jean R. St. Clair has been appointed Records Supervisor of the Academy–Research Council. A specialist in documentation and records management, Miss St. Clair first came to the Academy–Research Council in 1945. After a complete analysis of the Central Files, she established the system that is used for the Academy–Research Council's central records. Before rejoining the Executive Offices at the present time, Miss St. Clair served from January 1958 to September 1961 on the staff of the Food and Nutrition Board. As Records Supervisor, Miss St. Clair will be glad to extend assistance to other officers with records problems.

COOPERATING SOCIETIES

The following list of Societies cooperating with the National Academy of Sciences–National Research Council has been taken from the Library publication "Cooperating Societies, National Academy of Sciences–National Research Council, Officers and Meetings," revised September 1961. A limited number of copies of this publication are available upon request from the Librarian of the Academy-Research Council. Representatives of these societies serve as members of the Divisions which are shown in parentheses after the name of the society.

ACOUSTICAL SOCIETY OF AMERICA (Physical Sciences)
AMERICAN ACADEMY OF NEUROLOGY (Medical Sciences)
AMERICAN ACADEMY OF PEDIATRICS (Medical Sciences)
AMERICAN ANTHROPOLOGICAL ASSOCIATION (Anthropology and Psychology)
AMERICAN ASSOCIATION OF ANATOMISTS (Biology and Agriculture, and Medical Sciences)
AMERICAN ASSOCIATION OF IMMUNOLOGISTS (Medical Sciences)
AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS (Medical Sciences)
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Earth Sciences)
AMERICAN ASTRONOMICAL SOCIETY (Physical Sciences)
AMERICAN CERAMIC SOCIETY, INC. (Chemistry and Chemical Technology)
AMERICAN CHEMICAL SOCIETY (Chemistry and Chemical Technology)
AMERICAN COLLEGE OF PHYSICIANS (Medical Sciences)
AMERICAN COLLEGE OF SURGEONS (Medical Sciences)
AMERICAN CONGRESS ON SURVEYING AND MAPPING (Earth Sciences)
AMERICAN CRYSTALLOGRAPHIC ASSOCIATION (Chemistry and Chemical Technology, and Physical Sciences)
AMERICAN DAIRY SCIENCE ASSOCIATION (Biology and Agriculture)
AMERICAN DENTAL ASSOCIATION (Medical Sciences)
AMERICAN FEDERATION FOR CLINICAL RESEARCH (Medical Sciences)
AMERICAN GENETIC ASSOCIATION (Biology and Agriculture)
AMERICAN GEOGRAPHICAL SOCIETY (Earth Sciences)
AMERICAN GEOPHYSICAL UNION (Earth Sciences and Physical Sciences)
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (Chemistry and Chemical Technology, and Engineering and Industrial Research)
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (Engineering and Industrial Research)
AMERICAN INSTITUTE OF MINING, METALLURGICAL AND PETROLEUM ENGINEERS (Engineering and Industrial Research)
AMERICAN INSTITUTE OF NUTRITION (Biology and Agriculture)
AMERICAN INSTITUTE OF PHYSICS (Physical Sciences)
AMERICAN IRON AND STEEL INSTITUTE (Engineering and Industrial Research)
AMERICAN MATHEMATICAL SOCIETY (Mathematics)
AMERICAN MEDICAL ASSOCIATION (Medical Sciences)
AMERICAN METEOROLOGICAL SOCIETY (Earth Sciences, and Physical Sciences)
AMERICAN NEUROLOGICAL ASSOCIATION (Medical Sciences)
AMERICAN NUCLEAR SOCIETY (Chemistry and and Chemical Technology)
AMERICAN OIL CHEMISTS' SOCIETY (Chemistry and Chemical Technology
AMERICAN PHYSICAL SOCIETY (Mathematics and Physical Sciences)
AMERICAN PHYSIOLOGICAL SOCIETY (Biology and Agriculture, and Medical Sciences)
AMERICAN PHYTOPATHOLOGICAL SOCIETY (Biology and Agriculture)
AMERICAN PSYCHIATRIC ASSOCIATION (Medical Sciences)
AMERICAN PSYCHOLOGICAL ASSOCIATION (Anthropology and Psychology)
AMERICAN PUBLIC HEALTH ASSOCIATION (Medical Sciences)
AMERICAN ROENTGEN RAY SOCIETY (Medical Sciences)
AMERICAN SOCIETY FOR CLINICAL INVESTIGATION (Medical Sciences)
AMERICAN SOCIETY FOR ENGINEERING EDUCATION (Engineering and Industrial Research)
AMERICAN SOCIETY FOR EXPERIMENTAL PATHOLOGY (Medical Sciences)
AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE (Biology and Agriculture)
AMERICAN SOCIETY FOR METALS (Engineering and Industrial Research)
AMERICAN SOCIETY FOR MICROBIOLOGY (Biology and Agriculture, and Medical Sciences)
AMERICAN SOCIETY FOR PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS (Biology and Agriculture, and Medical Sciences
AMERICAN SOCIETY FOR TESTING MATERIALS (Engineering and Industrial Research)
AMERICAN SOCIETY FOR AGRICULTURAL ENGINEERS (Biology and Agriculture)
AMERICAN SOCIETY OF AGRONOMY (Biology and Agriculture)
AMERICAN SOCIETY OF ANIMAL PRODUCTION (Biology and Agriculture)

American Society of Biological Chemists (Biology and Agriculture, Chemistry and Chemical Technology, and Medical Sciences)
American Society of Civil Engineers (Engineering and Industrial Research)
American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (Engineering and Industrial Research)
American Society of Ichthyologists and Herpetologists (Biology and Agriculture)
American Society of Limnology and Oceanography (Biology and Agriculture, and Earth Sciences)
American Society of Mammalogists (Biology and Agriculture)
American Society of Mechanical Engineers (Engineering and Industrial Research)
American Society of Parasitologists (Biology and Agriculture)
American Society of Photogrammetry (Earth Sciences)
American Society of Plant Physiologists (Biology and Agriculture)
American Society of Plant Taxonomists (Biology and Agriculture)
American Society of Range Management (Biology and Agriculture)
American Society of Tropical Medicine and Hygiene (Medical Sciences)
American Society of Zoologists (Biology and Agriculture)
American Surgical Association (Medical Sciences)
American Veterinary Medical Association (Biology and Agriculture, and Medical Sciences)
American Welding Society (Engineering and Industrial Research)
Association for Computing Machinery (Mathematics)
Association for Symbolic Logic (Mathematics)
Association of American Geographers (Earth Sciences)
Association of American Physicians (Medical Sciences)
Biometric Society, Eastern North American Region (Biology and Agriculture, and Mathematics)
Biophysical Society (Biology and Agriculture, and Physical Sciences)
Botanical Society of America, Inc. (Biology and Agriculture)
Ecological Society of America (Biology and Agriculture)
Econometric Society (Mathematics)
Electrochemical Society, Inc. (Chemistry and Chemical Technology)
Engineering Foundation (Engineering and Industrial Research)
Entomological Society of America (Biology and Agriculture)
Genetics Society of America (Biology and Agriculture)
Geochemical Society (Chemistry and Chemical Technology, and Earth Sciences)
Geological Society of America, Inc. (Earth Sciences)
Illuminating Engineering Society (Engineering and Industrial Research)
Industrial Research Institute, Inc. (Engineering and Industrial Research)
Institute of Mathematical Statistics (Mathematics)
Institute of Radio Engineers, Inc. (Engineering and Industrial Research)
Institute of the Aerospace Sciences (Engineering and Industrial Research)
Institute of Traffic Engineers (Engineering and Industrial Research)
Instrument Society of America (Engineering and Industrial Research)
Mathematical Association of America (Mathematics)
Mineralogical Society of America (Earth Sciences)
Mycological Society of America (Biology and Agriculture)
Operations Research Society of America (Mathematics)
Optical Society of America, Inc. (Physical Sciences)
Paleontological Society (Biology and Agriculture, and Earth Sciences)
Poultry Science Association (Biology and Agriculture)
Radiation Research Society (Biology and Agriculture, and Physical Sciences)
Seismological Society of America (Earth Sciences)
Society for Industrial and Applied Mathematics (Mathematics)
Society for Investigative Dermatology, Inc. (Medical Sciences)
Society for Pediatric Research (Medical Sciences)
Society for the Study of Development and Growth (Biology and Agriculture)
Society of American Foresters (Biology and Agriculture)
Society of Automotive Engineers, Inc. (Engineering and Industrial Research)
Society of Economic Geologists (Earth Sciences)
Society of Economic Paleontologists and Mineralogists (Earth Sciences)
Society of Exploration Geophysicists (Earth Sciences)
Society of General Physiologists (Biology and Agriculture)
Society of Naval Architects and Marine Engineers (Engineering and Industrial Research)
Society of Photographic Scientists and Engineers (Engineering and Industrial Research)
Society of Protozoologists (Biology and Agriculture)
Society of Systematic Zoology (Biology and Agriculture)
Society of Vertebrate Paleontology (Earth Sciences)
Soil Science Society of America (Biology and Agriculture)
Wildlife Society (Biology and Agriculture)

RECORD OF MEETINGS

July

1 Mohole Project, Drilling Panel, *Dallas*

6 Committee on International Exchange of Persons, Local Members

8 Advisory Committee to the Chemical Notations Systems Project, *Boston*

10 Committee on Pest Control-Wildlife Relationships

11 Office of Scientific Personnel, Discussion Group on Trends in Manpower Research

12 AASHO Road Test, Review Subcommittee for Report 4 on Bridges and Advisory Panel on Bridges, Joint Meeting, *Chicago*

13–14 Committee on Fellowships in Physiological Psychology, *Boulder, Colo.*

16–20 Committee on Agricultural Policy in Education, *Stillwater, Okla.*

17 Committee on Atmospheric Sciences, *Boston*

19 Advisory Committee on the Follow-up Study of Radiologists

19–21 Ad hoc Committee on Energy, *New York City*

20 Institute of Laboratory Animal Resources, Executive Committee

Highway Research Board Department of Soils, Geology, and Foundations, Ad hoc Committee on Reorganization

24 American Miscellaneous Society Committee

27–28 Highway Research Board, Department of Economics, Finance, and Administration

27–29 Symposium on Nomenclature of Organic Chemistry, *Columbus, Ohio*

28 Steering Committee for Urban Transportation Research

Conference on Radiation Problems in Manned Space Exploration

August

1 Federal Construction Council, Operating Committee

1-2 Committee on Metallic Materials

2 Federal Construction Council, Task Group 39-30R on Underground Heat Distribution Systems

2 Highway Research Board, Ad hoc Committee on Purpose and Scope for Department of Traffic and Operations

3 Conference on Microbiology of Jet Fuels

3-4 Highway Research Board, Department of Traffic and Operations, *Chicago.*

7 Highway Research Board, Special Committee on Public Dissemination of Research Findings

7-8 U. S. National Committee, International Federation of Documentation

7-12 Conference on Sex and Behavior, *Berkeley, Calif.*

8 Highway Research Board, Steering Committee

Highway Research Board, Nomination Committee

Building Research Advisory Board and Building Research Institute, Joint Policy Committee

9-11 AASHO Road Test, Committee on Materials

11 Institute of Laboratory Animal Resources, Committee on Primates

12 Committee on Atmospheric Sciences

14 Agricultural Research Institute, Projects and Proposals Committee

14–17 Ad hoc Committee on Renewable Resources, *Woods Hole, Mass.*

18–19 Committee on Naval Medical Research, *New London, Conn.*

21 Committee on Atmospheric Sciences

21–22 Committee on Rigid Pavement Design, Subcommittee on Prestressed Pavements

21–24 Ad hoc Committee on Educational Policy for Agriculture, *Woods Hole, Mass.*

26–27 Working Group on Immunotransfusion in the Treatment of Burns

30 Federal Construction Council, Task Group 39-30R on Underground Heat Distribution Systems

NEW PUBLICATIONS

Abdun-Nur, Edward A. *Fly Ash in Concrete, an Evaluation.* Washington, 1961. (NAS–NRC Publication 854. Highway Research Board Bulletin 284.) 138 p. $3.00.

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Criscuolo, E. L., *et al. The Feasibility of X-Ray Inspection of Welds Using Back Scattered Radiation.* Washington, NAS–NRC, 1961. (Ship Structure Committee. Ser. No. SSC-132.) 26 p.

Federal Construction Council. Task Group T-29 on Thermal Insulation for Piping. *Thermal Insulation for Piping.* Washington, 1960. (NAS–NRC Publication 896. Report No. 41 for the Federal Construction Council.) 34 p. $2.00.

Guedry, Frederick E., and Graybiel, Ashton. *Rotation Devices, Other Than Centrifuges and Motion Simulators . . . A special Report Prepared . . . for the Panel on Acceleration Stress, Armed Forces–NRC Committee on Bio-Astronautics.* Washington, 1961. (NAS–NRC Publication 902.) 40 p.

Hutchinson, H. W. *Field Guide to Brazil.* Washington, 1960. (NAS–NRC Publication 908. Division of Anthropology and Psychology, Committee on International Anthropology, Field Guide Series No. 5.) 59 p. $1.25.

IGY World Data Center A: Rockets and Satellites. *Corpuscular Radiation, Magnetic Field, and Micrometeorite Observations with Satellites and Space Probes.* Washington, NAS–NRC, 1961. (IGY Satellite Report No. 14.) 193 p., illus. $1.00.

International Symposium on Military Psychology, Brussels, 1957. *Proceedings, First International Symposium on Military Psychology. Edited by Frank A. Geldard and Marilyn C. Lee . . . 26–27 July, 1957, Brussels, Belgium.* Washington, 1961. (NAS–NRC Publication 894.) 225 p. $2.50.

Leddicotte, G. W. *The Radiochemistry of Tellurium.* Washington, NAS–NRC, Committee on Nuclear Science, Subcommittee on Radiochemistry, 1961. (Nuclear Science Series; Report No. [30-38]) 42 p. $0.50. (Available from: Office of Technical Services, Dept. of Commerce, Washington 25, D.C.)

National Research Council. Building Research Institute. *Mechanical Fasteners for Industrial Curtain Walls.* Washington, 1961. (NAS–NRC Publication 916.) 24 p. $2.00.

National Research Council. Building Research Institute. *Preassembled Building Components. Proceedings of a Program Conducted as Part of the 1960 Fall Conferences . . .* Washington, 1961. (NAS–NRC Publication 911.) 179 p., illus. $8.00.

National Research Council. Committee on Geography. *Coastal Geography, a Report of a Conference . . .* Washington, NAS–NRC, 1961. 17 p.

National Research Council. Committee on International Nutrition Programs. *The Role of Nutrition in International Programs.* Washington, NAS–NRC, 1961. [12] p.

National Research Council. Committee on Protein Malnutrition. *Progress in Meeting Protein Needs of Infants and Preschool Children. Proceedings of an International Conference Held in Washington, D.C., August 21–24, 1960 . . .* Washington, 1961. (NAS–NRC Publication 843.) 569 p., illus. $5.00.

National Research Council. Highway Research Board. *The AASHO Road Test; History and Description of Project.* Washington, 1961. (NAS–NRC Publication 816. Highway Research Board Special Report 61A.) 56 p., illus. $2.40.

National Research Council. Highway Research Board. *Bituminous Construction Operations.* Washington, 1961. (NAS–NRC Publication 820. Highway Research Board Bulletin 280.) 22 p., illus. $0.60.

National Research Council. Highway Research Board. *Bridge Design Studies and Piling Tests 1960.* Washington, 1961. (NAS–NRC Publication 819. Highway Research Board Bulletin 279.) 85 p. $1.80.

National Research Council. Highway Research Board. *Formulating Highway Construction Programs. Workshop Conference Proceedings, September 19–20, 1960.* Washington, 1961. (NAS–NRC Publication 817. Highway Research Board Special Report 62.) 208 p. $4.00.

National Research Council. Highway Research Board. *Freeway Operations.* Washington, 1961. (NAS–NRC Publication 857. Highway Research Board Bibliography 28.) 14 p. $0.60.

National Research Council. Highway Research Board. *Mineral Aggregates, 1957–1959. Annotated [Bibliography].* Washington, 1961. (NAS–NRC Publication 858. Highway Research Board Bibliography 29.) 30 p. $0.80.

National Research Council. Highway Research Board. *Motor Vehicle Time and Fuel Consumption.* Washington, 1961. (NAS–NRC Publication 814. Highway Research Board Bulletin 276.) 91 p. $2.00.

Notice of Academy Meetings

NATIONAL ACADEMY OF SCIENCES

Autumn meeting, University of California at La Jolla and Los Angeles, October 29–November 1, 1961

Annual meeting, Washington, D. C., April 23–25, 1962

NATIONAL ACADEMY OF SCIENCES–NATIONAL RESEARCH COUNCIL

Governing Board, Washington, D. C., December 10, 1961

Governing Board, Washington, D. C., February 11, 1962

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The search for Truth is in one way hard and in another easy. For it is evident that no one can master it fully nor miss it wholly. But each adds a little to our knowledge of Nature, and from all the facts assembled there arises a certain grandeur.

—ARISTOTLE